

plates. If this could have been done solely by himself; or, as he was obliged to seek assistance in this delicate process, if it could have been performed immediately under his eye, he would have been relieved of much anxiety; and would have better maintained a due equanimity; his mind being daily ruffled by the negligence of his assistants; who too often, through a deplorable want of skill and taste, made disgusting caricatures of what were intended to be modest imitations of simple nature. Hence much of his precious time was spent in the irksome employment of inspecting and correcting the imperfections of others."

In a letter to the Editor of the WILSON BULLETIN for September, 1928 (XL, 208), the present writer intimated that William Bradford, Wilson's publisher, maintained "a shop of colorists". From what has now been set down it is manifest that he spoke with too great assurance and to erroneous effect. In this he afterward was very properly corrected by Mr. Burns (WILSON BULLETIN, March, 1929; XLI, 20).

Surely this receipt-book and the associations that cluster about it go far to restore, to create before the mind's eye, a picture of the episode—a major episode in the story of Wilson's life. And as we contemplate that picture, our sympathy must be quickened, and our appreciation deepened of the accomplishment of this inspired school-master.

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SNOW-KILLING OF THE BOB-WHITE

BY THOS. G. SCOTT*

Reports of ground-roosting birds imprisoned by snow or sleet may be found in various ornithological publications, and occasionally popular articles with illustrations appear relating to birds killed by exposure to the weather. However, convincing evidence that snow imprisonment occurs and actually results in death to the prisoners is scarce.

The data included in this paper may provide conclusive evidence that, at least in one instance, reasonably strong Bob-whites (*Colinus virginianus virginianus*) were imprisoned and killed by drifting snow. In addition, it will be pointed out that other birds of the same covey met death by exposure to severe weather in spite of apparent physical fitness and the protection of normally acceptable cover.

The notes supporting this paper were incidental to observations upon emergency feeding practices. However, the notes are detailed

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enough to be significant and are adequately warranted by photographs. The writer is indebted to Dr. H. H. Knight of Iowa State College for the accompanying photographs.

The covey of Bob-whites under observation was located on the Little Wall Area by Mr. Robert I. Simpson and the writer during a preliminary survey to prospective emergency feeding operations. This inspection was carried out on the twenty-eighth day of January. The birds were using a plum (*Prunus*) and willow (*Salix*) thicket as a day roost. The thicket was growing upon a slight embankment immediately to the northwest of a marsh which in that region is largely grown up to river bulrushes (*Scirpus fluviatilis*). The embankment and thicket provided excellent mechanical protection from the prevailing northwest winds, and the skyward branching of the thicket insured the birds against the attacks of winged predators. At that time there were approximately twenty-one birds in the covey. It may be of interest to note that both Bob-whites and Pheasants (*Phasianus colchicus torquatus*), in apparent tolerance of each other, were using this thicket almost to the exclusion of one or two available willow thickets which were, if possible, more exposed to the wind. The birds were not fed during this visit, but later, on February 2, shelled corn was placed in the thicket by emergency feeders.

On February 8 the most severe blizzard of the season occurred. The writer, interested in its effect upon wildlife, drove to the Little Wall Area to observe the birds already mentioned. Under protected



FIG. 2. The thicket. The snow-prison was at the writer's feet, and the highest level of the drift is being indicated upon the willow clump.



FIG. 3. This shows the night-roost group and the approximate positions of the single birds collected on the same day.



FIG. 4. A close up of the night-roost group. The singles, probable victims of exposure, have been placed near the night-roost group for comparative reasons.

conditions the temperature was 15° below zero, but it was probably ten to fifteen degrees lower in the face of the thirty to forty mile an hour gale which was blowing. Although but three inches of snow fell during the day, there was enough of it in the wind to make visibility very low and to cause extensive drifting. The visit was made at 10 A. M., and at that time the snow was drifting rapidly. The Bob-whites and Pheasants were both at the thicket, but the cover was proving inadequate to the test. A part of the Bob-whites were in a night-roost formation, and the others were scattered throughout the cover. Iced snow was seen upon the head and upper neck of a few Pheasants and Bob-whites. Two of the Bob-whites, weakened by the weather and encumbered by an incasement of snow and ice upon their heads, were noticeably helpless. Without difficulty these birds were collected by hand, and the others flew into the bulrushes. The eyes and nostrils of the captured birds were sealed with iced snow, but the mouth was clogged with neither ice nor snow. Although helpless and decidedly subject to predation in the face of the blizzard, these birds revived hurriedly once within the ear. The ear was unheated, hence served only to break the wind. The wind undoubtedly carries snow to the head of a bird, but, what is more important, keeps it there. As the roads were rapidly becoming impassable, the writer was forced to leave the field.

It was impossible to return to the area for three days. On February 11 the roads were again passable, and a trip was made to the thicket to view the results. Upon approaching the thicket, one live bird was seen to make a reasonably strong flight away from the opposite side. The cover was drifted with from four to eight feet of snow, and there was but little sign indicating that live birds were using it. After a short search, one dead bird was found with its head projecting above the snow. It was facing into the blizzard, as were all Bob-whites found dead through exposure in this covert. The drift was too extensive to attempt shoveling to the birds which were possibly somewhere within, so an intensive watch was kept upon the drift as soon as melting began on February 23.

The notes concerning each member of the covey accounted for may possibly be handled to the best advantage as follows:

Bob-white I—Male; taken alive February 8; weight 176.2 grams.

Bob-white II—Male; taken alive February 8; weight 194.2 grams.

Note: Bob-whites I and II were the specimens taken during the blizzard. Although the weights indicate reasonably healthy birds

(Errington 1931a), they were extremely susceptible to predation and would undoubtedly have died from exposure. These birds were kept in captivity at the college, and their weights were taken again on March 6. Bob-white I—181.5 grams. Bob-white II—197 grams.

Bob-white III—Male; found dead February 11; weight 185 grams. The crop of this bird was empty, but the stomach contained corn. The weight again indicates a reasonably strong bird.

Bob-white IV—The lone living bird seen three days after the blizzard. Its flight was strong and vigorous.

Bob-white V—Female; found dead March 8; weight 135 grams. This was one of the first birds to appear after the melting began on February 23. It was found approximately four feet below the highest level of the drift. The snow was pushed or melted back from the body of the bird on all sides for about four inches, thus forming a small compartment and indicating that the bird may have lived beneath the snow for a short time.

Bob-white VI—Male; found dead March 8; weight ? It was not considered of any particular value to weigh the bird in that its head was gone. The breast contour and stomach analysis would indicate a bird of about 180 grams. Later the head was found a few inches lower in the snow leaving evidence that the attack had occurred during the blizzard. Circumstantial findings indicated that the predator was a mink (*Mustela vison vison*).

Bob-white VII—Male; found dead March 15; weight 175 grams.

Bob-white VIII—Male; found dead March 15; weight 182 grams.

Bob-white IX—Male; found dead March 15; weight 118 grams.

Note: Bob-whites VII, VIII, and IX are the birds pictured in Fig. 4, just back of the covey group. The weights of VII and VIII would signify strong birds. From the fresh appearance, lack of snow compartment and findings by stomach analysis it is quite likely that they perished from exposure. The weight of IX indicates a very weak bird. A snow compartment was not seen about the bird, but that may have been due to untimely observation. The low weight and stomach analysis would indicate death through trapping beneath the snow.

Bob-white X—Male; found dead March 15; weight 104 grams.

Bob-white XI—Male; found dead March 15; weight 96 grams.

Bob-white XII—Female; found dead March 15; weight 120 grams.

Bob-white XIII—Male; found dead March 15; weight 116 grams.

Note: Bob-whites X, XI, XII, and XIII are the birds composing the night-roost group in Fig. 3 and Fig. 4. These birds quite obviously met death through imprisonment. The difference in outward

appearance may readily be seen by comparison with the three birds in the background. Notice the droppings and the steamed or drenched appearance of the birds in the night-roost group. The body weights are all below that which commonly deeds a Bob-white the right to live in the wild. The stomach analysis tends to clinch the argument that the birds perished through imprisonment. It is interesting to note that Bob-white XIII was heavily infested with lice (*Coniodes ortygis* Dcn.). Imagination might conceive of these lice moving from the dead or dying birds to XIII as the last living bird.

STOMACH ANALYSIS

Bob-white	Color of Stomach Lining	Weight of Stomach (full)	Weight of Stomach (empty)	Weight of Grit	Weight of Food and Other Remaining Material	Body Weights
V	Dark green	7	4.83	1.25	.92	135
VI	Green	8.35	5.2	1.27	1.88	†
VII	Green	9	5.8	1.15	2.05	175
VIII	Green	7.1	4.87	1.01	1.22	182
IX	Black	6.55	4.72	1.00	.83	118
X*	Black	5.2	3.85	.75	.60	104
XI*	Black	5.15	3.78	.64	.73	96
XII*	Black	6.03	4.21	.97	.85	120
XIII*	Black	5.5	4.30	.79	.41	116

†See Bob-white V note.

*Night-roost group.

The quantitative stomach analysis denotes that the imprisoned Bob-whites of the night-roost group died in much poorer condition than did those birds which died from exposure. Birds V and IX, for which former circumstantial evidence implied death by imprisonment, also show a tendency to be poorer than the exposed birds, but still not so poor as the night-roost group. Color of the stomach lining may or may not be of importance, however, the darker colors seem to be associated with the imprisoned birds. The comparatively small amount of grit found in the stomachs of the night-roost group and the lack of food provides evidence to the fact that they must have remained alive in their snow-prison for some time. The birds in the night-roost group probably died from a combination of starvation and suffocation. The exposed birds presumably died from a combination of suffocation and cold.

Nine of the original covey are unaccounted for, but this is not an entirely unusual happening. Frequently entire coveys of birds disappear from their chosen coverts only to be found by diligent searching in open corn fields many yards away. (Errington, 1936). Perhaps this entire covey would have done the same thing had not

part of them been unable to leave due to death or imprisonment. The accounted-for birds may have moved into the bulrushes where the drifting was less severe and without the characteristic crust found where the wind was able to play upon the surface of the snow. The Pheasants did this very thing and came through well except for those birds which remained too near the embankment. The embankment provided a break for drifting, and the wind froze a crust over it for some yards out into the marsh. One male Pheasant was seen to break its way up through this crust and escape after three days of imprisonment. The crust at this point was strong enough to support a man's weight.

Although drifting and undue cold is an infrequent occurrence, it appears worthy of the game manager's attention, especially in the provision and strengthening of cover. Cover which encourages drifting may be perfectly acceptable during the greater part of the year, but it certainly fails in the face of the final test. The primary purpose of good cover is that of offering protection from predators. Cover, drifted full of snow, fails in this respect and often becomes a trap to birds trusting in its protection. Future research into management practices should include the effect of drifting upon normally acceptable cover and the possibility of controlling it.

A great many ideas for controlling the drift may enter one's mind. But are they practicable, and if so, are they inexpensive and simple enough to be practiced by the ordinary landowner?

SUMMARY

1. Reasonably healthy Bob-whites may perish through imprisonment by drifting snow.
2. Exposure to cold, high winds and snow may kill reasonably healthy Bob-whites.
3. Cover, subject to heavy drifting, is not ideal.
4. Research into management practices should include work upon the effect and control of drifting snow.

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